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# Maine Agricultural Experiment Station

BULLETIN No. 121.

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## THE COTTONY GRASS SCALE.

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This bulletin contains a description of the cottony grass scale, together with its life history, natural enemies, remedial measures and bibliography.

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## THE COTTONY GRASS SCALE.

*Eriopeltis festuæ* (Fonsc.).

EDITH M. PATCH.

*Economic Significance.*—Until recently the cottony grass scale has not seemed to merit treatment from the economic standpoint, for the experience of this insect since it was first observed in America had led to the conclusion that it would be an intermittent thing very quickly brought under control by natural agencies.

During the summer of 1904, however, considerable consternation was caused in several localities in Maine by the presence of the egg sacs of this scale in enormous numbers. From Sedgwick and all along the Eggemoggin Reach; from the vicinity of Portland, especially at Gorham and Stroudwater; from Dresden and from Manchester, came persistent and alarmed reports. "My mowing lands look as though scattered with swollen rice grains," "A strange fungus has destroyed large plots in my grass lands," "The hay fields look as if a slight shower of snow pellets had fallen over them," were among the descriptive comments.

This infestation doubtless was not so sudden as it seemed. The scale is inconspicuous until the egg sac is secreted, thus for most of its life only a careful search would reveal its presence. The egg sacs themselves are only about one-fourth of an inch in length and these could be scattered along fence and road ways, over uncut grass near streams, unnoticed for years, and in view of the fact that comparatively few people are keen observers of little things not in their special line of interest, the statements that "we have never seen anything like this before," do not necessarily signify that the creatures have not been breeding within stone's throw for 40 years. However, the cottony grass scale is admirably fitted for rapid increase as the enormous

number of eggs in a sac (600 to 700), the lively disposition of the young scales and their ability to travel, and the fact that there are at least two broods a season, all indicate.

The insidious approach of this insect may be illustrated by this experience. During the late summer and early fall of 1904 in the vicinity of Orono, careful searches were made for egg sacs over large areas, some of which appeared to be entirely free from the scale and others attacked in an exceedingly scattering manner. This fall, 1905, the increase in the places of scattering infestation is very marked, and even over some areas apparently free last season the egg sacs are a common though not yet a conspicuous occurrence. In one Orono meadow which contained an infested plot last fall, the egg sacs have increased certainly one hundred fold in a year's time.

#### NATURAL CHECKS.

Whether such increases are occasions for real alarm is a question involving a consideration of natural agencies as checks.

*Weather.*—While the eggs within the sacs are safe in ordinary climatic conditions, the young larvæ, minute, delicate, and unprotected, must be largely dependent upon favorable conditions between the time of leaving the sac and settling upon a promising blade. A heavy rain at this time must undoubtedly beat down and destroy myriads of the little creatures.

*Rust.*—In a meadow near Portland thickly infested with the scales, areas half a mile in length were observed to be attacked heavily by rust. This was the 25th of August, 1904, when many of the scales were from one to three weeks old. The situation of the rust spots along the leaf resembled so closely the position selected by the scales that it suggested the possibility of some relation between the rust and the scales. In view of the fact that fungi are predisposed to attack parts of plants wounded by insects or in other ways, it seems legitimate to conclude that the grass rusts in scale infested meadows would be most likely to settle at places punctured by the scales. The development of rust could not but interfere with the scales upon the same leaf, and death of the scales result indirectly from the presence of the rust. It was an interesting, if not a significant circumstance, that in the Portland meadow the rust was much more conspic-

uous in the places where there were most egg sacs of the grass scale and where the blades must have been freely punctured by the young scales. Yet on the blades most attacked by the rust no living scales remained. There seemed to be no practical way of obtaining reliable data in this case, but there would be nothing extraordinary in a reduction of scales through the weakening of the host plant by fungus agencies. Such a remedy, however, would prove a severe one for the hay crop.

*Predaceous Insects.*—Large numbers of fresh egg sacs were frequently observed (1904 and 1905) to be torn open near the end or at the side, and a considerable portion of the eggs in such cases would be missing. This seemed to be the work of some predaceous insects, but none were observed in the act.

*Overcrowding.*—Sometimes more young scales than one leaf could possibly support are found crowded upon a single blade. In such cases death of some of the scales must result, or a drying of the blade which would cause the death of all the scales upon it.

*Parasites.*—Nor are parasites lacking. For one test lot nearly two quarts of egg sacs were collected August 1, 1904, in a meadow near Portland. On August 3, such numbers of the minute larvæ hatched and swarmed over the jars that it seemed improbable that parasites were present to any appreciable extent. Two days later, however, parasitic hymenoptera began to emerge. There were more than 100 of these, among which a new species of *Eunotus* and a species of a new genus were about evenly represented, and there were a few of a new species of *Microterys*. About 30 parasitic dipterons, *Leucopis nigricornis* Egger., a European species, also emerged from this lot. Less than 150 parasites from many thousand sacs, however, would not mean an extended diminution of the scales for that generation.

The following year, 1905, about the middle of August, egg sacs were collected near Orono for greenhouse observations. These were too extensively parasited to yield a sufficient number of larvæ for the experiments planned. From 262 sacs collected about the same time from the Isle of Springs, 98 hymenopterous parasites emerged. No dipterous parasites appeared in this collection.

This will suffice to show that among the natural agencies that tend to check the increase of cottony grass scale, parasites are especially efficient. A list of the parasites reared during two years' observation of Maine material is given on a subsequent page.

#### NATURE OF INJURY.

Like plant-lice and other hemipterous insects, scales weaken their host plant by piercing the tissues with their sharp pointed beaks and sucking the sap. Sometimes as many as 10 or 12 egg sacs are found attached to one blade, which means that for weeks, 10 or 12 scales have been draining sap from that blade. Where the infestation is excessive the result is dead grass and brown plots here and there through the field. Where the infestation is less serious, it still means a shrinkage in the hay crop corresponding to the amount of grass which has been impoverished through the loss of sap. During 1904 and 1905 the places of worst infestation in certain Portland meadows were revealed by irregular brown areas of dead grass.

#### REMEDIAL MEASURES.

The point in regard to the life history of this insect which is most significant in view of remedial measures is that the scale passes the winter in the egg stage within the white egg sacs attached to the grass blades, well up above the ground. Thus a spring burning of the infested grass land will destroy the whole generation unhatched, without injury to the grass. In some instances this will mean a burning over of more than 50 acres, but in some the infestation is as yet restricted to spots a few rods square here and there in the meadows. It is advisable in districts where the scale has been especially conspicuous to burn the grass along roadsides and in neglected corners, either in the early spring or in the fall, so that such places will not serve as breeding places for the scale.

It is not improbable that if the fields should be left to themselves the parasites, or other natural agencies, would in time master the scales and the grass lands contain only scattered scales which would do practically no harm. As it is quite impossible to predict whether such an adjustment, were it to



come about, would take 2 years or 20, it is certainly much safer to relieve the parasites of the responsibility and burn over the badly infested grass lands. Owners of grass lands can with comparative ease control the situation, and failure to destroy the pest is likely to place a heavy tax upon the hay crop in the infested districts.

A practical demonstration of the worth of this remedial measure was given on Deer Isle last spring (1905). The meadows there had been seriously attacked by the grass scale for several years. During the summer of 1904 the hay crop was reckoned at a third less than the usual amount and the hay was reported to be inferior in quality. Several of the fields were burned over the following spring. Concerning this, one of the meadow owners writes about October twentieth, "We have hardly seen a scale since burning the land last spring. The hay crop was unusually large and we think it did the land good to burn it over."

#### LIFE HISTORY NOTES.

*Description and Habits.*—The white egg sacs, appearing like "a strange fungus" attached to grass blades, are what have attracted attention to the cottony grass scale. This is not a stage of progressive injury, but of quiescence. The eggs deposited by the fall brood of scales winter in the protective oval cases. The active larvæ emerge during the warm spring days and seek a suitable grass blade. That they are able to travel for a considerable distance at this time was proven by the sprightly journeys of these microscopic creatures in the laboratory. In confinement as many as 50 have been observed to settle upon one grass blade. (Figures 2 and 3). In the field a single blade with 12 full sized egg sacs is sometimes found, though the number is usually much less. Probably more than 12 could scarcely mature upon one leaf, but 20 to 30 young scales to the blade were not at all an unfrequent occurrence in Portland meadows. Once accepting a favorable location, the young scale must abide by its decision, for after piercing the blade with its minute beak the insect becomes stationary, the legs atrophy and a little clear delicate scale rests flat upon the blade, continuously draining the plant of sap. The scales invariably settle head down the blade, sometimes on the under side but more frequently

on the upper surface. What the physiological effect would be of imbibing constantly for 6 to 11 weeks in this position might seem a trifle uncertain as a matter of conjecture, but it certainly works all right as a practical demonstration and when the time finally comes to secrete the egg sac, the advantages of this peculiar habit become evident. During July when the scale has attained full size, a snow white felty covering of curly filament is secreted, fitting closely over the entire body. If the secretion is removed before the female has begun to deposit eggs a plump, smooth, oval, slightly pink, object is found to be quite filling the closed sac. When it begins to deposit eggs, the female scale pushes the anterior end of its body through the sac in front, breaking open the end pointed downward. Then slowly contracting as the eggs are laid, the scale becomes, by the time the sac is filled with eggs, a shrivelled helpless object already nearly dead. Sometimes it remains in the opening forming a plug for the sac, but more often it drops to the ground.

The oval sac is usually slightly more than quarter of an inch in length. One fair sized sac contained 740 pinkish yellow eggs. The closed end being directed uppermost, the eggs are more thoroughly protected than otherwise would be the case. Enough filaments of the sac are scattered among the eggs to hold them in place.

The eggs of this summer generation hatch in July and August, and the scales mature in the fall, secreting before winter (in October and early November for Maine) sacs in which the eggs remain until spring.

*The Male Scales.*—No adult males were captured during the two seasons. Three male pupæ were found among 136 mounted scales taken from grass blades in Portland, August 17, 1904. The wing pads, antennæ and legs were distinct in all. One was more nearly mature than the others and seemed about to emerge. Most of the female scales mounted at this time range from  $1\frac{1}{2}$  to 3 millimeters. The male pupæ are less than  $1\frac{1}{2}$  millimeters long, while a full grown female scale often measures a little over 6 millimeters. The male scales would naturally be expected to appear before the females begin to secrete the cottony covering.

*Number of Generations.*—From the middle of July to August 4, 1904, freshly formed egg sacs as well as egg sacs from which

larvæ were emerging were collected in great numbers at Gorham, Portland, Dresden, and along the Eggemoggin Reach. From the middle of October to November 3, 1904, the females were observed to be secreting egg sacs and depositing eggs in fields near Orono, Portland, and Sedgwick, and unhatched egg sacs were gathered in Portland, November 22, 1904.

Field data, and material sent to this station during 1904 were sufficient proofs of two generations, the first maturing and secreting egg sacs in July and the first of August, and the second depositing eggs (in sacs as before) during late October and early November. In this egg stage the insect winters, the young scales emerging in the spring.

*Life Cycle.*—On several occasions, from sacs gathered from different parts of large fields on the same day and kept in jars in the laboratory, all the larvæ emerged within a few days of each other. Thus it seemed probable that the life cycle was passed with considerable evenness and regularity. But this conclusion was contradicted by the circumstance that on August 1-4, 1904, there were found, within a few feet of each other, sacs in which the eggs were not yet hatched, others from which larvæ were emerging and scales of various sizes ranging apparently from one to three weeks in age.

There was no way to tell from field observations as to the exact length of the scale life, so April 12, 1905, egg sacs were gathered for laboratory observations. Many of these were hatched April 28 and the larvæ were liberated upon transplanted June grass sod in the greenhouse. They settled upon the grass readily, over 50 placing themselves upon single blades in some cases. In about two weeks when the scales were well established the sod was again transplanted to cold frames where the conditions were much as they would be in the open field. They were exposed to much cold weather and considerable rain. On July 12 nine plump sacs newly filled with eggs were picked. It had been 11 weeks from the hatching of the scale to the deposition of eggs within the sac. Some of the scales in this lot were not so far advanced and had not begun to deposit eggs, although the scales were covered with a thin cottony secretion.

An interesting check to these observations was found in a second lot which had developed in the greenhouse upon redtop. The newly hatched larvæ were liberated on June 16. On July

19, they were secreting the white sacs and were as far advanced as the slower portion of the cold frame lot, which were 11 weeks old.

As the foregoing observations show, the time required for development depends much upon the temperature, and it seems fair to conclude that a long hot season might give opportunity for 3 broods where the scales are favorably situated. A cold wet summer would probably preclude the development of more than two broods. This seems to be the usual number for Maine, but with such circumstances as scales within a few feet of each other ranging from one day to at least a month in age it would be difficult to be sure that 3 generations were not a frequent occurrence in warm sunny fields.

A simple test was made with 3 lots of eggs as to their power to withstand cold under unnatural conditions.

On April 28, two sealed jars containing egg sacs from which the larvæ were beginning to emerge were placed in a refrigerator. These were labeled No. 1 and No. 2. A third jar, No. 3, was filled the same day with egg sacs newly gathered which had not begun to hatch. These jars remained in the refrigerator until June 6 when they were placed in the greenhouse. June 16 the eggs in jar No. 3 began to hatch. The larvæ were liberated among red-top upon which they settled. These developed, secreting egg sacs from the 19th to the last of July. Seven weeks retardation by cold did not injure these eggs. The eggs in jars No. 1 and No. 2 subjected to the same treatment did not hatch. These, however, were just on the point of hatching when they were placed in the refrigerator and were taken at an unfair advantage.

#### KINDS OF GRASSES INFESTED.

The egg sacs collected in Maine have been upon June grass, *Poa pratensis*, and red-top, *Agrostis alba*. Where specimens have been sent in on broken bits of grass, as is frequently the case, identification of the host was of course impossible; but so far as the observations of the past two seasons have gone, these are apparently the only two infested grasses yet reported for Maine.

## PARASITES.

A large number of egg sacs was collected from June grass in a meadow near Portland the first of August, 1904. For the most part the material was cut close to the sacs, with only a bit of the grass blade left attached. There was included, however, a little infested grass, cut stalk and all, a circumstance which will doubtless account for the presence (in the list appended) of *Lasioptera* and *Isosoma*, insects of grain, or grass-stalk inhabiting proclivities. The single specimen of *Eupelmus* may not necessarily, therefore, have been parasitic upon the grass scale itself. Considering the fact that some species of *Oscinis* are stem maggots and that the larvæ of many species of the same genus are reported as preying upon Coccidae,\* the economic position of the two specimens of this insect may also be open to question at present. The remaining species, however, are bred from egg sacs of *Eriopeltis festuca*. No. 11 and No. 12 were reared from material collected on Isle of Springs, August 9, 1905.

These insects were submitted to Dr. L. O. Howard, chief of Bureau of Entomology, U. S. Department of Agriculture, whose kindness in examining them makes this report possible. All of the Hymenoptera were examined by Dr. W. H. Ashmead, U. S. National Museum, to whom thanks is also due. The following insects are listed as Dr. Howard reported them, except for the addition of the number of specimens reared in each case.

- No. 1. *Leucopis nigricornis* Egger. 30 specimens.
2. *Eunotus* n. sp. 36 specimens.
3. New genus near *Phaenodiscus* in Mirini. 32 specimens.
4. *Microterys* n. sp. 4 specimens.
5. Probably males of No. 3. 18 specimens.
6. *Lasioptera* sp. 1 specimen.
7. *Eupelmus* sp. 1 specimen.
8. *Isosoma* sp. 1 specimen.
9. *Lasioptera* sp. 1 specimen.
10. *Oscinis* sp. 2 specimens.
11. *Eunotus* n. sp. How. Many specimens.
12. *Eunotus* n. sp. How. Many specimens.

\* U. S. Dept. Agr., Div. of Ent., Bul. 32, p. 35.

## BIBLIOGRAPHY.

The published accounts of this insect are meagre, as little attention has been paid to it.

An interesting popular description of *Eriopeltis festucæ* given by Mr. E. A. Butler in Knowledge, July 2, 1894, p. 148, reads as follows:

"This forms little compact oval tufts, like pieces of cotton wool, attached to the stems and blades of certain grasses, and there is certainly nothing whatever in their external appearance to suggest any connection with insects, unless, indeed, they might be cocoons of small ichneumon flies. But a close examination, revealing a number of separate threads standing out in all directions, would soon dispel this idea, and would leave their real nature as problematic as ever. Though apparently not uncommon, they have not long been generally known in this country (England) having previously, no doubt, been overlooked, partly because of the little attention that was until recently paid to the Coccidæ, and partly because of the completeness of their disguise. They seem to have been first noticed in this country in 1856, when there is a reference to them in the *Proceedings of the Entomological Society of London*; but that was soon forgotten, and they passed out of knowledge till 1885, when Mr. Q. C. Bignell again called attention to them."

Dr. James Fletcher, in his report of the Canadian Experimental Farms for 1895, (Ottawa, 1896) pp. 145-147, gives an account of an outbreak of the cottony grass scale with references to literature.

Following are references to the Genus *Eriopeltis* as corrected by Mrs. C. H. Fernald from her catalogue\* of the Coccidæ of the World.

GENUS ERIOPELTIS Sign. Type, *lichtensteinii*.

*Eriopeltis*, Sign., Ann. Soc. Ent. Fr., (5), i. p. 429 (1871): Kll., Can. Ent. xxxi, p. 332 (1899).

## I. ERIOPELTIS BRACHYPODII Giard.

*Eriopeltis brachypodii* Giard, Bull. Soc. Ent. Fr., (7), iii, p. cxcix (1893).

\* Mass. Experiment Station, Bulletin No. 88.

*Eriopeltis brachypodii* Butler, "Knowledge," p. 148 (1894).

*Eriopeltis brachypodii* Fletcher, Rep. Can. Exp. Farms, p. 146 (1896).

Habitat.—France.

On *Brachypodium pinnatum*.

## 2. ERIOPELTIS FESTUCÆ (Fonsc.).

*Coccus festucæ* Fonsc., Ann. Soc. Ent. Fr., iv. p. 216 (1834).

*Coccus festucæ* Kalt., De Pflanz., p. 747 (1874).

*Eriopeltis festucæ* Sign., Ann. Soc. Ent. Fr., (5), ix, p. 46 (1879).

*Eriopeltis festucæ* King, Can. Ent., xxxiii, p. 197 (1901).

*Eriopeltis festucæ* Butler, "Knowledge," p. 148 (1894).

*Eriopeltis festucæ* Fletcher, Rep. Can. Exp. Farms, p. 146 (1896).

Habitat.—Europe; Nova Scotia; Canada; Illinois; Indiana; Dakota.

On *Festuca cæpitosa*; *F. phœnicioides*.

## 3. ERIOPELTIS LICHTENSTEINII Sign.

*Eriopeltis festucæ* Sign. (non Fonsc.) Ann. Soc. Ent. Fr., (5), i, p. 430 (1871).

*Eriopeltis lichtensteinii* Sign., Ann. Soc. Ent. Fr., (5), vi, p. 607 (1876).

*Eriopeltis lichtensteinii* Sign., Bull. Soc. Ent. Fr., (5), vii, p. xxxvi (1877).

*Eriopeltis festucæ* Sign., Bull. Soc. Ent. Fr., (5), vii, p. xxxvi (1877).

*Eriopeltis festucæ* Bignell, The Entom., xviii, p. 286 (1885).

*Eriopeltis lichtensteinii* Dougl., Ent. Mon. Mag., xxiv, p. 166 (1887).

*Eriopeltis lichtensteinii* Newst., Ent. Mon. Mag., xxvii, p. 165 (1891).

Habitat.—France; Holland; England; Scotland.

On *Festuca* spp. and other grasses.

## EXPLANATION OF PLATES.

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Cottony Grass Scale. *Eriopeltis festucae* (Fonsc.).

- Figure 1. Egg sacs on Red-top.  
“ 2. Upper surface of June-grass blade. Enlarged. Showing the number and position of young scales on May 10, 1905, twelve days after the active larvæ were liberated in greenhouse.  
“ 3. Under surface of same blade on same date.  
“ 4. Active larva x 120. Ventral view. Showing normal insect appendages.  
“ 5. Young scale x 44. Ventral view. Scale taken August 17, 1904. Showing atrophied condition of antennæ and legs.  
“ 6. Egg x 80.  
“ 7. Full grown female scale. Natural size. Removed from sac before any eggs were deposited.  
“ 8. Pupa of male scale x 55. Taken August 17, 1904.





FIG. 1.



FIG. 2.



FIG. 3.



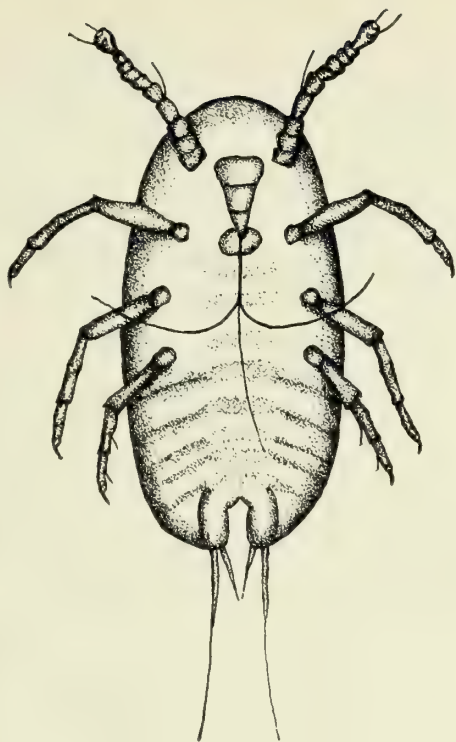


FIG. 4.



FIG. 5.



FIG. 6.



FIG. 7.

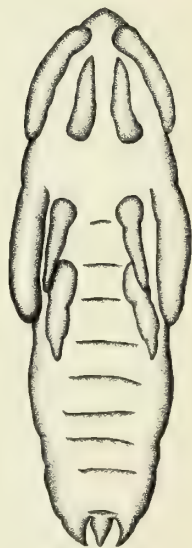


FIG. 8.



